(d) REMARKS

The claims are 1-5 with claim 1 being independent. The claims have been amended to improve their format which changes are unrelated to patentability. Reconsideration of the claims in view of the arguments presented hereafter is respectfully requested.

As requested by the Examiner in Fig. 1 reference character "103b" has been corrected to read --113b--. In addition, in Fig. 5 a typographical error in the caption has been corrected. No new matter has been added.

The objection to claims 1-5, particularly claims 1 and 2, has been resolved by appropriate amendments in accordance with the Examiner's kind suggestions.

Claims 1-5 were rejected under Rule 112, second paragraph, as being indefinite. The limitation "said glow discharge" in claim 1, line 7 has been amended to read --a glow discharge--. Accordingly, the objection should be withdrawn.

Claims 1-5 were rejected as obvious over Itoh '029 in view of Takaki '160. The Examiner admits Itoh does not teach that the high frequency power can be in the range from 50 to 550 MHz. Takaki is said to remedy that defect.

Claims 1-5 were also rejected as obvious over Yamagami '481, Akiyama '071, Takaki '425 or Takaki '504, each in view of Itoh '029. Finally, claims 1-5 were rejected as an obviousness-type double patenting over claims 25 and 26 of Yamagami '481, over claims 6 and 7 of Takaki '425 or in view of claims 5 and 12 of Takaki '504, each in view of Itoh '029. The Examiner admits the primary references applied do not teach that the intervals of the electrodes to the substrate are all different or in part different,

or that the intervals are periodically changed relative to a transportation direction of the substrate. The grounds of rejection are respectfully traversed.

Prior to addressing the grounds of rejection, Applicants wish to briefly review certain key features and advantages of the present claimed invention. It is an important feature of the invention that the bar-shaped electrodes are arranged in intervals to the substrate which are all different or in part different. It is another key feature that the high frequency power source employs a high frequency power with an oscillation frequency from about 50 to 550 MHz.

Applicants have found that to form a high quality microcrystalline silicon series thin film on a substrate with excellent overall properties at reasonable cost, it is important, inter alia, to use a plurality of bar-shaped electrodes in which their intervals to the substrate are all different or in part different and that the high frequency power source for causing glow discharge is from about 50 to 550 MHz. As shown in Figs. 2-5, when the power source frequency is below about 50 MHz or above about 550 MHz, then adverse results are found. In particular, an amorphous silicon is found when the high frequency power is less than about 50 MHz. At a frequency above about 550 MHz, the distribution of grain size, grain quality and hydrogen content in the film is undesirably broad and non-uniform. Further, as disclosed in paragraphs [0111] and [0112], where the oscillation frequency is less than about 50 or greater than about 550 MHz, then the film surface tends to be clouded and roughened, polysilane was apparently incorporated into the film and there was unevenness of the film property in the width direction.

In Comparative Example 1-1 on page 31, when a flat plate-type electrode is employed as in Fig. 12, then, as disclosed on page 32, film thickness distribution is found to be beyond 15% for Comparative Example 1-1 as set forth in paragraph [0132]. Further, amorphous portions were present and distributions of crystal volume, hydrogen content and absorption coefficient were unsatisfactory as set forth in paragraph [0133].

In Comparative Example 1-2, bar-shaped electrodes were spaced to have equal intervals to a substrate. As noted in Tables 2 and 3 on pages 45 and 46, and in paragraphs [140-148], it is not possible to form a microcrystalline silicon series thin film whose properties are desirably controlled in the thickness direction where the intervals between the electrodes and substrate were equal. In particular, in the present claimed invention, it is possible to change various important properties to compensate for the changes in film thickness. On the other hand, when the interval between the substrate and electrode is not changed, such compensating features to mitigate variations in distribution are not possible.

The Examiner's attention is also directed to Comparative Example 2 in which the intervals of the bar-shaped electrodes to the substrate were all equal, as set forth in paragraph [0165]. The Examiner's attention is directed to the results in Tables 4-6 and 9 as noted in paragraphs [0168]-[0177]. Where the intervals to a substrate are changed, it is possible to prepare a photovoltaic element which is superior in photovoltaic element characteristics as compared to employing a plurality of bar-like shaped electrodes in which the intervals are constant.

In Itoh '029, to the contrary, the high frequency power in each of the embodiments is regulated to be 13.56 MHz, as set forth in column 6, line 25; column 7, line 55 and column 9, line 24. The comparative test results at such frequencies are shown in Figs. 2-5 of the present invention. As described in paragraphs [111-112] an oscillation frequency less than 50 MHz causes the surface of the film to be degraded, amorphous portions to be formed and polysilane to be incorporated into the film. Further, Takaki '160 teaches that frequencies down to 30 MHz and up to 600 MHz are suitable. Accordingly, the instant comparative results showing unexpectedly superior properties clearly rebuts any presumption of prima facie obviousness raised by a combination of Itoh and Takaki.

In paragraph 9 of the outstanding Official Action, the Examiner noted that the rejection could be overcome by showing the references were disqualified under 35 U.S.C. §103(c). For the record, Applicants state that U.S. Patent No. 6,076,481 to Yamagami et al., U.S. Patent No. 6,152,071 to Akiyama, U.S. Patent No. 6,065,425 to Takaki and U.S. Patent No. 6,279,504 to Takaki and the subject patent application No. 10/656,130, were, at the time the invention of Application No. 10/656,130 was made, owned by the same Assignee, Canon Kabushiki Kaisha of Tokyo, Japan. Accordingly, since each of these references has been disqualified, then the art rejection in paragraph No. 9, has been rendered moot and should be withdrawn.

With regard to the obviousness-type double patenting rejection, the Examiner has admitted that claims 25 and 26 of the '481 patent, claims 6 and 7 of the '425 patent and claims 5 and 12 of the '504 patent do not recite that the intervals of the electrodes to the substrate are all different or, in part, different. As noted In re Vogel, 164

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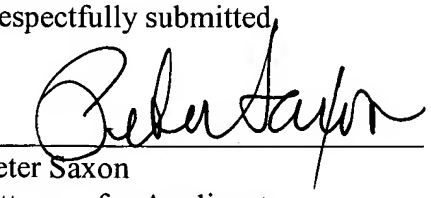
USPQ 619 (CCPA 1970), if a rejected claim defines more than an obvious variation from a cited reference claim, it is patentably distinct. Applicants have demonstrated that the presence of the intervals which are different or in part different, provide unexpectedly superior results over electrode to substrate distances which are constant. Accordingly, such evidence rebuts any possible presumption that the claims of the present invention are merely obvious variations of the claims of the cited references.

Wherefore, Applicants submit that none of the references, whether considered alone or in combination, disclose or suggest the claimed invention nor render it unpatentable. In addition, the claims of the subject application are distinct from the claims of the references applied for the double patenting rejection.

Accordingly, it is submitted that the claims should be allowed and that the case be passed to issue.

Applicants' undersigned attorney may be reached in our New York office by telephone at (212) 218-2100. All correspondence should continue to be directed to our below listed address.

Respectfully submitted,



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(b) Amendments to the Drawings

A replacement sheet for Fig. 1 and for Figs. 4 and 5 is enclosed. In Fig. 1, reference character "103b" has been corrected to --113b--.

In Fig. 5, the term "CCONTENT" has been corrected to read --CONTENT--.